ABSTRACT OF THE DISCLOSURE

A process is provided for producing elemental sulfur from hydrogen sulfide contained in an acid gas feed stream wherein hydrogen sulfide and sulfur dioxide are reacted in a catalytic only sulfur recovery unit comprising a single catalytic converter containing a Claus catalytic reaction zone. A sulfur dioxide-enriched gas recovered from tail gas treatment is recycled and introduced into the catalytic reaction zone as part of a feed gas mixture that also includes the acid gas feed stream. Temperatures within the catalytic reaction zone are effectively moderated by recycle of tail gas effluent to the converter so that high concentrations of hydrogen sulfide in the acid gas feed stream can be tolerated and improved process flexibility and capacity are realized. A pretreatment process including contacting the acid gas with an aqueous acid wash to reduce the concentration of unsaturated hydrocarbons in the acid gas and inhibit deactivation of the oxidation catalyst is also disclosed.